
Deploying New Tritium D&D Technologies in the US--Recent Experience and Plans

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Contamination and Decontamination
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Large Scale Demonstration and Deployment Project (LSDDP)

- **Purpose:** Seeks to identify and deploy technologies that will allow D&D (decontamination and decommissioning) of tritium contaminated surplus facilities more quickly, at less cost and with reduced risk to personnel and the environment.
- **Facilities:** Los Alamos, Princeton, Lawrence Livermore, Mound, Savannah River, (Lawrence Berkeley?)
- **Funding:** DOE-Environmental Management
- **Schedule:** Phase one completed over three years. Phase two is just beginning and will be two to three years.
- **Participation:** International participation is encouraged

Mound Site Was Focus of Phase One



Main Hill Tritium Complex



TSTA Will be the Focus of Phase Two



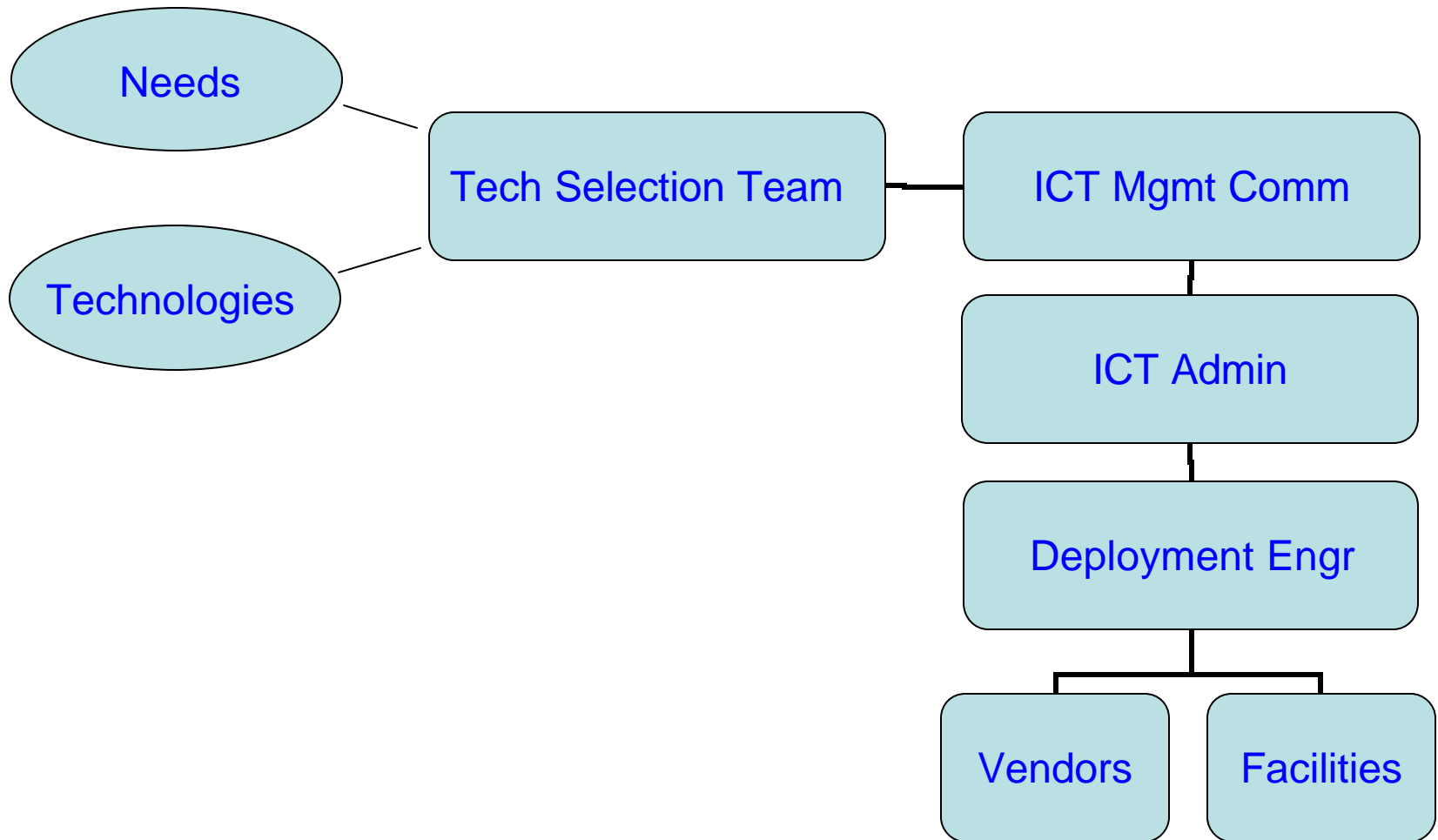
Needs being addressed

- Waste handling and disposal—water oils and solids
- Tritium characterization—surface and bulk
- Dismantlement and demolition
- Personal protective equipment
- Gas detritiation
- Tritium air monitoring
- Decontamination of equipment and materials
- Surface stabilization (fixatives)
- Long-term surveillance and maintenance

LSDDP Approach

- Identify needs (facilities)
- Identify field-ready technologies (technology committee)
 - Review and assess technologies
 - Rank technologies for order of preference
 - Develop a demonstration or deployment proposal
- Authorize the technology
- Designate Lead Test Engineer
- Develop Test/Work plan
 - Finalize schedule/cost estimate
- Acquire the technology
- Demonstrate/deploy the technology / collect data
 - Compile data / develop reports
- Issue report

LSDDP Organization



Technologies Demonstrated

- Overhoff “Flat Ferret” Ionization Direct Reading Tritium Detector System
- Technical Associates Inc. PTS-27 Gas Ionization Direct Reading Tritium Detector System
- Lumi-Scint Portable Liquid Scintillation Counter
- Waterworks Crystals Superabsorbent Polymer (WWC)
- NOCHAR Petrobond® oil solidification polymer
- Burndy Hydraulic Crimper
- LLNL Tritium Clean-up Cart
- Fiber-optic scintillation tritium detector for High Activity Liquids
- Rad Elec passive tritium air & surface monitor
- SAMMS heavy metals removal from liquids
- Enthral Heavy Metals Removal Material

Technologies Demonstrated - cont.

- TMS-2000 Direct reading surface tritium monitor
- TechXTract Tritium Decontamination System
- Barter Process for Recycling Equipment Into the Commercial Sector
- WIC® Waste Isolation Composite for solidifying high activity tritium

Technologies Scheduled

- Scintillation Vial Disposal System
 - Vial shredder feeding into No Char
- Concrete Tritium Characterization
 - Hammer drill with collection system

Direct Reading Tritium Survey Monitors

- Baseline swipes counted in Stationary Liquid Scintillation Counter
 - Swipes transported from the contamination area, inherent delays in turn-around time
 - Reduce productivity, increase costs, delay workers awareness of the area contamination
- Flat Ferret and TA Unit Not Effective
 - Increasing background and inconsistent contamination readings
 - Cause of these inconsistencies appears to be loose dirt or dust
- TMS-2000 Showing Promise
 - Improvements made in newer model
- PIN Diode quite effective, but not presently industrialized

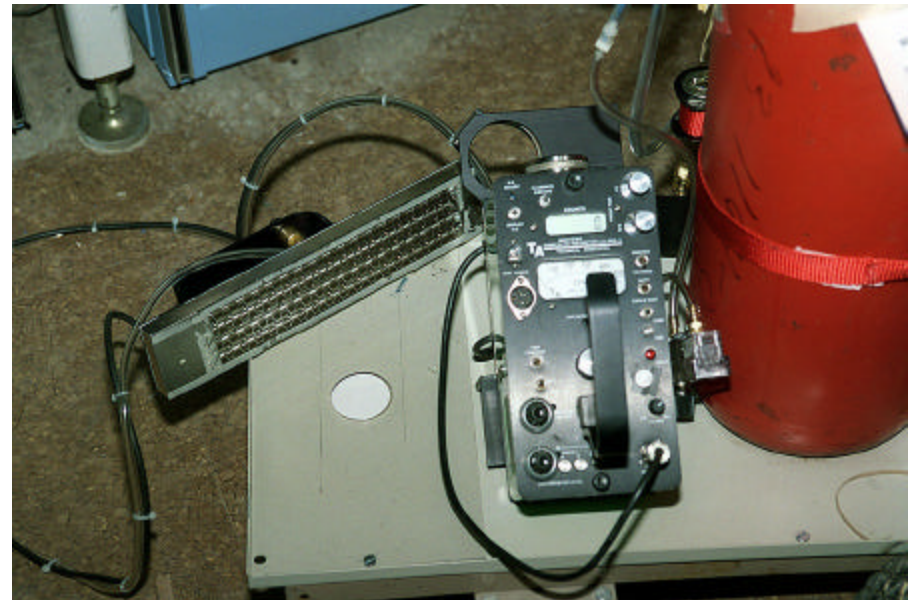


TMS 2000 Tritium Detector

Tritium Surface Monitors



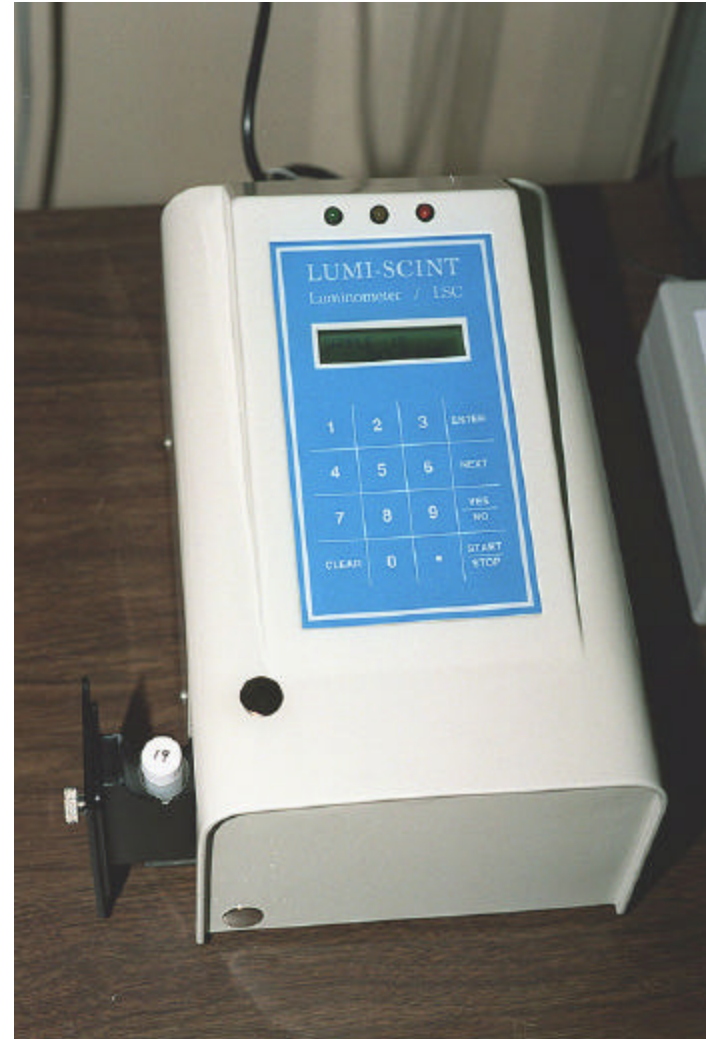
Overhoff "Flat Ferret"



*Technical Associates
PRS-5/TRS-27*

Lumi Scint--Portable Liquid Scintillation Counting System

- Baseline swipes counted in Stationary Liquid Scintillation Counter (LSC)
 - Swipes transported from the contamination area, inherent delays in turn-around time
 - Reduce productivity, increase costs, delay workers awareness of the area contamination



Lumi Scint with drawer open

Portable LSC Results

- Effective & easy to use
- Consistent readings
- Not practical for routine, high quantity activities - not automated
- Cost effective for quantities < 60 samples at a time
- Deployed to PPPL & SRS



*Lumi Scint compared to
baseline scintillation counter*

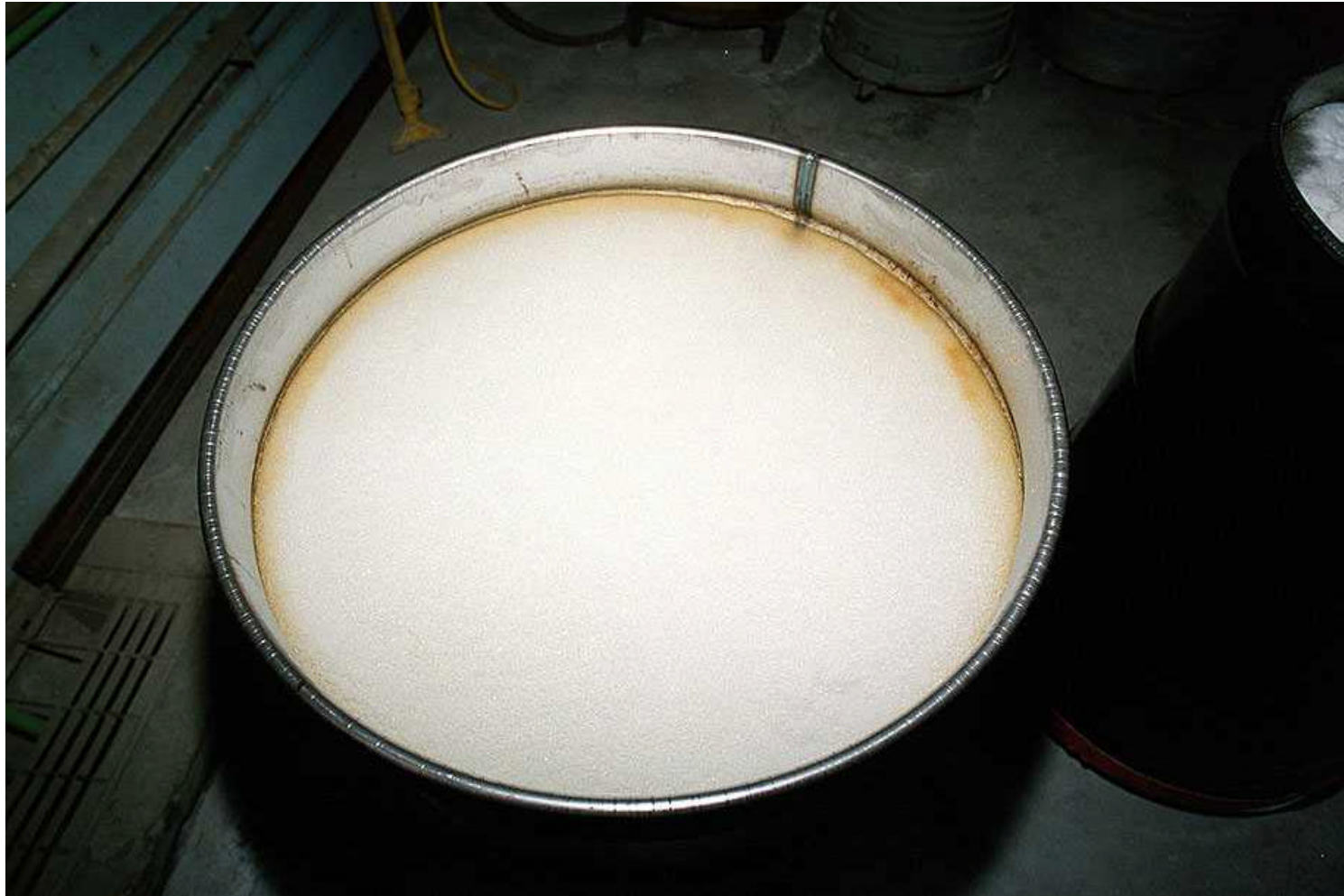
WaterWorks Superabsorbent Water Solidification

- Based upon polyacrylate superabsorbent
- Solidifies 53 vs 42 gal in a 55 gal drum
- 4x cost savings per gal water
- Deployed to Ashtabula and PPPL



Waterworks at 75:1 ratio

53 gal. Water Solidified by about 1 gal (dry) WaterWorks



Nochar Petrobond® Polymer Tritiated Oil Solidification

- 100's of gallons of oil - much mixed waste
- No baseline (enabling)
- Passed TCLP
- Accepted at Nevada Test Site
- Saved >\$100,000 in just demonstration
- Deployed at Mound, Ashtabula, SRS, REFETS, Battelle-Columbus, Sandia-Albuquerque, PPPL



Dry Petrobond



*1:1 Mixture of
Petrobond with Oil*

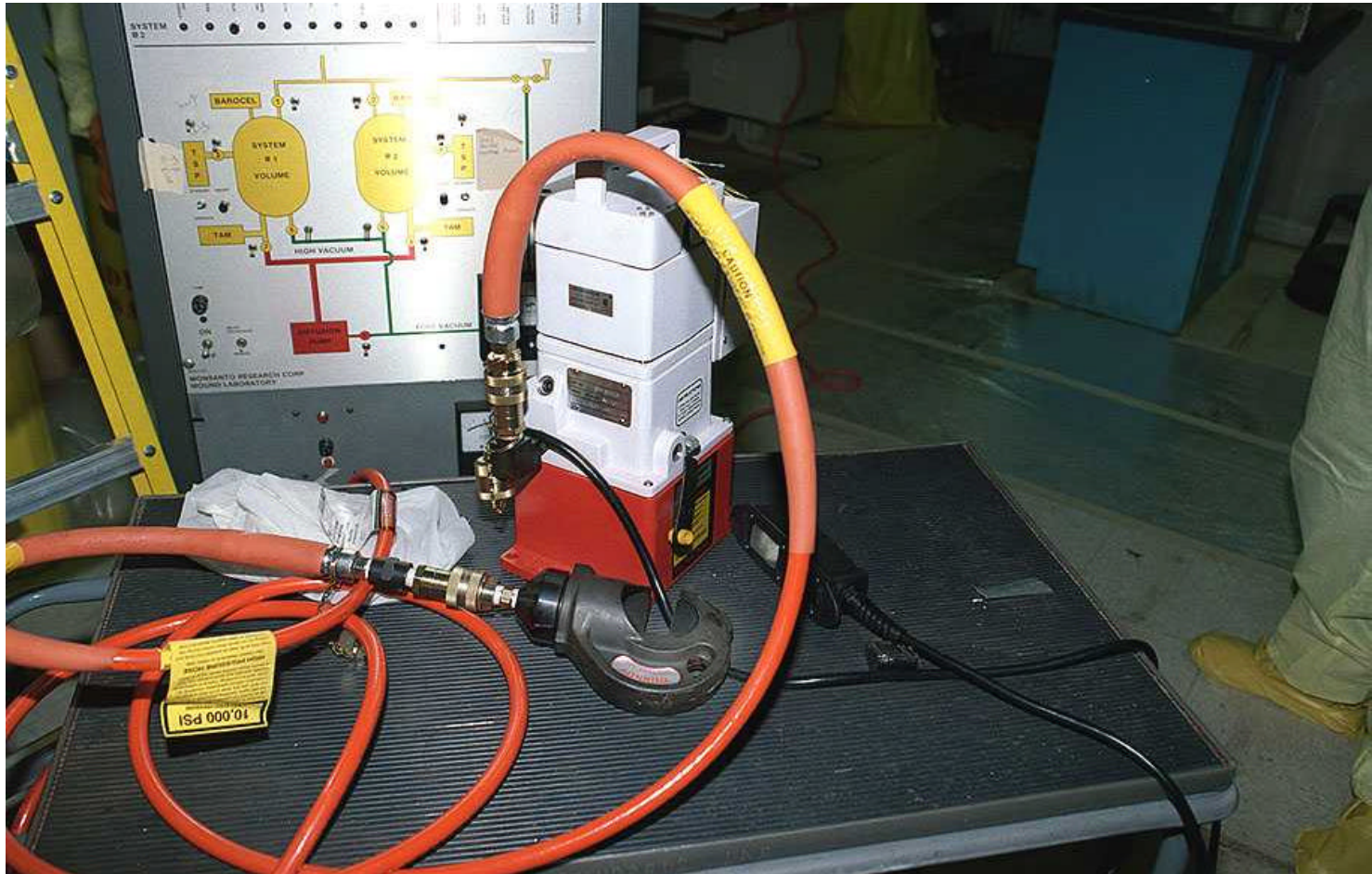
Burndy Crimper Tritium Transfer Line Isolation

- Miles of tubing transported tritiated gases - Baseline to cut and cap
- Phase One redesigned the crimper die
- Phase Two noted no release of tritium
- Worker input improved process
 - Crimping & folding to fit containers.
- Immediate deployment at Mound

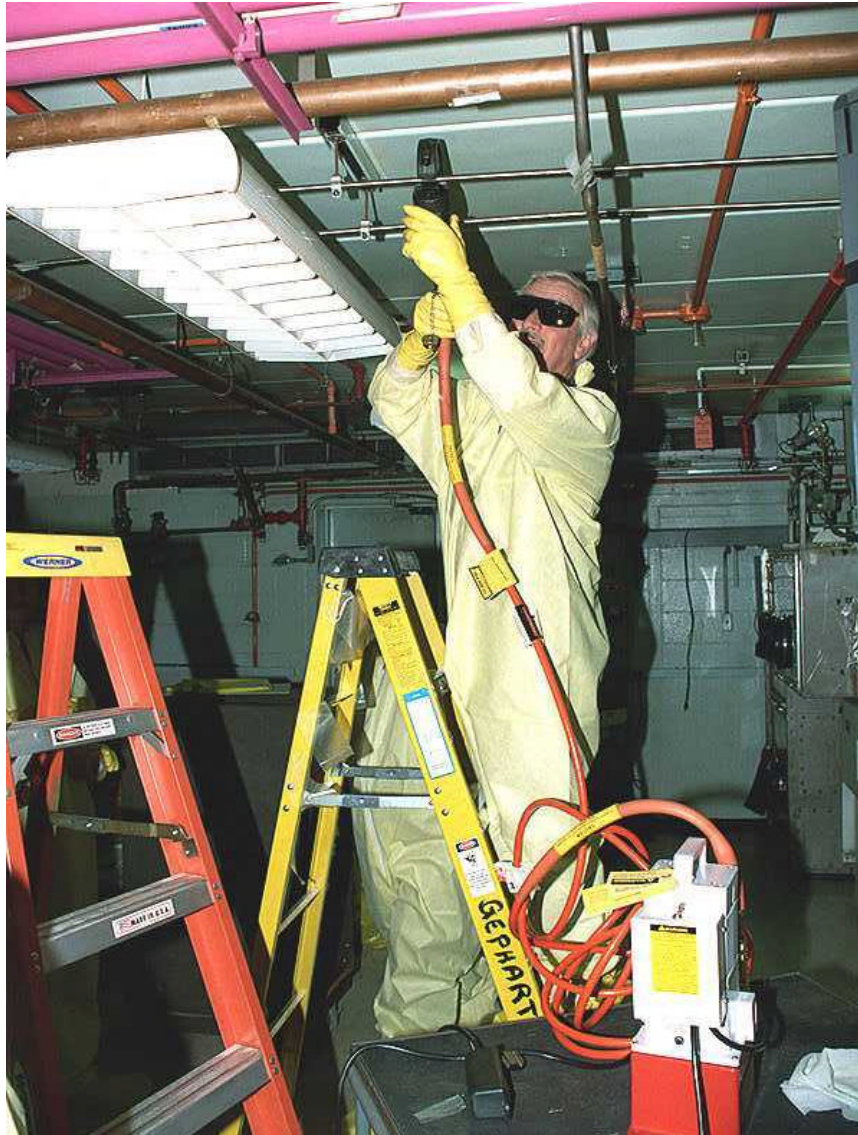


Crimper and die heads

Burndy hydraulic pump and head



Crimping double-walled tubing



Tubing after crimp and cut

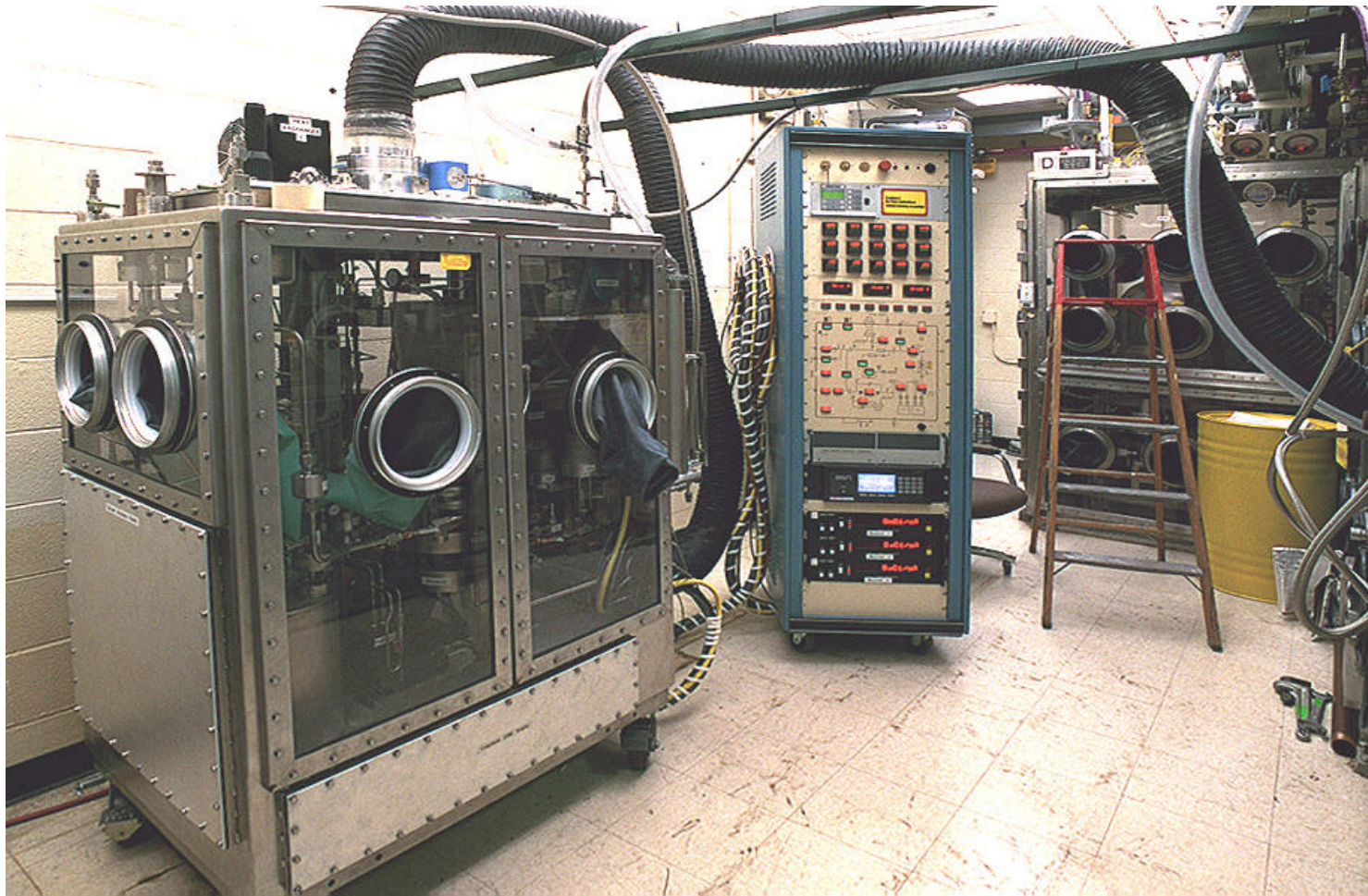


LLNL Tritium Clean-up Cart

- System needed for contaminants which are catalyst poisons harmful to the (TERF)
- Successful in decontaminating the glovebox
- Tritium levels started at 663 micro Ci/m³ stabilized at 205 micro Ci/m³
 - Captured more tritium than indicated
- Wanted by PPPL, LANL, LLNL



Cart, Control Panel and Interconnections



SAMMS

- Self-Assembled Monolayers on Mesoporous Support (SAMMS)
- Mound and Other Sites Have Large Quantities of Mixed Waste Oils
- The Baseline Technology of No Char Cannot Always Address Higher Concentrations of Metals
- SAMMS Can be Used With the Baseline to Address this Issue
- SAMMS sequestered most Metals to <LLD and all below the LDR limits
- Performance of No Char was enhanced by 300% when used in combination with SAMMS

- The solidification of high activity tritiated water >500 Ci/l requires a nested packaging of 3 drums with asphalt barriers between drums
- The asphalt barrier presents concerns for regulatory agencies
- Baseline agent is mix of cement and Plaster of Paris
- Waste Isolation Composite (WIC) has several attract properties for a waste form
 - Low porosity
 - Low interconnectivity
 - High strength
 - High leach resistance
- Cold testing done to determine optimum mix ratios for the baseline and WIC
- Tritiated waste will be solidified and subjected to:
 - ANS 16.1 Leach Test,
 - immersion test,
 - compression test
 - offgas measurement

The Barter Process

- Numerous gloveboxes and other items that are potentially reusable
- Historically - reuse limited DOE sites
- The National Recycling Center has a formal process allowing transfer of contaminated items to NRC Licensees
- Liability is transferred from DOE to the licensee
- Resulted in:
 - Equipment transferred to NSSI (\$1.4M cost savings)
 - Problematic waste will be shipped pending resolution of some institutional issues (metal recycling)

First LSDDP Equipment Shipment



TechXTract®

- Some equipment, if deconned, could be reused
- Spills of tritiated liquids onto concrete can present special decon problems
- The technology is a combination of chemical solutions
 - They penetrate the surface, releasing the tritium which is then removed by creating a differential pressure on the surface



TechXTract® Results

- PPPL
 - Metallic surfaces were decontaminated
 - Hydrogen peroxide is the baseline
- At LLNL,
 - Concrete floors are to be treated
 - Scabbling is the baseline
- At PPPL, TechXTract performed better than Hydrogen peroxide
 - Minimal secondary waste was generated
 - Low regrowth of tritium on the deconned surface
- Mobilization occurring at LLNL
- Great success achieved with similar product at Rocky Flats for Pu glovebox decontamination

Concrete Characterization

- Combines hammer drill with a collection system which captures all of the concrete powder
- Used successfully to develop a concrete depth profile



Summary

- Expect 18-20 demos by conclusion of phase one
- Planning for 20 deployment in phase two
- The LSDDP effort has been effective at matching D&D needs with new technologies
- LSDDP has resulted in good communication across the DOE complex, and beyond
- This is a completely open process and others are invited to participate